

SPACE -- NEW FRONTIER FOR THE PLASTICS INDUSTRY

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NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
Langley, NEB VirginiaSpeech at
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It is a great pleasure and privilege to be present and participate in the opening ceremonies of the Ninth National Plastics Exposition. You are engaged in the architecture of atoms and molecules, in the exploration of the infinite variety of materials of diverse properties which may be assembled for application to the purposes of man in home, factory, and market place and in his travel by automobile, railway, ship, airplane, or spacecraft. I represent a large industrial, university, and governmental team engaged in the use of your products and of many others in the architecture of costly and complex devices--rockets, spacecraft, instrumentation--to explore the celestial bodies and outer reaches of space. We are all then explorers at the frontiers of science and engineering in the Age of Space seeking new materials, new knowledge, and new accomplishment for the benefit of man.

I am not an expert in the plastics field and frankly I know little about the ramifications of the industry. However, I did note from McGraw-Hill's forecast of the prospects of growth through 1975, entitled "The American Economy," that "the future for plastic materials is exceedingly bright. Output should approach 25 billion pounds in 1975 compared with nearly 6.5 billion pounds in 1960. Among the big uses that lie ahead are these: in homes--walls ceilings, and furniture; in industrial plants--pipes, dies, and heavy bearings; in consumer goods--auto body parts and housings for large appliances." The use of plastics in space exploration will probably not be measured in billions of pounds, but I can assure you that meeting the requirements for space will challenge your technical knowledge to the limit. Each success in meeting new goals of extreme heat, extreme cold, extreme vacuum, extreme speed will bring you knowledge to benefit the less spectacular and less publicized applications.

Our present century has been marked by successive periods of emergence of new fields and new industries, like your own, which have placed ever-increasing demands for higher performance under more and more severe environmental conditions. The Automotive Age, the Air Age, the Nuclear Age, the Space Age--these terms bring to mind the major landmarks. The century has been a century of opportunity, a century of change and challenge. There have always been new and challenging frontiers of science and technology, changing frontiers, and

the end is not yet in sight. We have found and will continue to find that at each frontier the materials and knowledge developed for one use have proved to be transferable to other uses, bringing progress everywhere in the scientific and technological foundations of our culture and its cherished enterprises, for national defense, for raising the standard of living, for improving the welfare of all mankind.

Although most of you are probably familiar with the present varied uses of plastics in space exploration, I will review briefly some of them. Practically every satellite launched to date has included one or more solid-propellant rockets, and there is widespread interest in the extension of this technology to very large rockets. Most of the presently available solid propellants use a plastic binder which also serves as fuel in which finely divided oxidizing agents are embedded. The plastic binder is often polyurethane, a polyester or a nitropolymer. Others such as epoxy plastics have also been suggested. The plastic weight may amount to about one-fourth the total propellant weight, and thus as large solid rockets are developed and come into use, the space and missile solid-propellant requirements taken together may well constitute a sizeable usage.

Other uses include ablation materials, surface sealant coatings, potting compounds, rocket cases and nozzles, fairings, inflatable structures, and probably many others not known to me. Many of these applications involve plastics reinforced with glass, asbestos, or other fibers, ceramic or metal flakes, or powders. Glass-fiber-reinforced plastics are used in the nose fairings, radomes, engine housings, flame shield, and thrust chamber of the Atlas launch vehicle. Thor-Able and Delta launch vehicles use a solid rocket with glass-fiber-reinforced plastic case. In the Tiro II weather satellite, the two-channel radiometer is practically all plastic, even to the conical optical elements used to gather infrared and other radiation from the earth. The detector elements are flakes made from a thin polyester sheet of Mylar.

The plastic industry with hundreds of other industries had a stake in Alan Shepard's flight and those of the other astronauts to come. Foamed-in-place urethane is used in the astronaut's couch and in parts of his space suit, particularly the helmet. As you know, the couch is made by pouring the plastic and foaming it to meet the required physical specifications in a mold fitted to the shape of the individual astronaut's body to give support against high loads on acceleration and deceleration, including those of reentry and impact. Glass-fiber-reinforced plastic is used in the heat shield which protects the astronaut from the extreme heat developed as the capsule reenters the atmosphere from its orbital speed of 18,000 miles per hour.

On May 25th President Kennedy recommended to the Congress and to the public an important national decision to establish as a national

goal the landing of a man on the moon and returning him safely to earth before this decade is out. The President emphasized the major national commitment of scientific manpower, material, and facilities and the degree of dedication, organization, and discipline that would be required to attain this goal.

In my opinion, the specific goal of manned lunar landing and return is but a symbol of the more important immediate result--the development of scientific knowledge and the advancement of engineering knowledge and technology at the frontiers of science and engineering required to reach this goal. This new goal of space exploration will produce new challenges to the plastics industry and to each of you as individual citizens, for, as the President said, "But in a very real sense it will not be one man going to the moon--it will be an entire nation. For all of us must work to put him there."

Symbolic of the role of plastics in space exploration at present is the Echo communications satellite. This is an extremely light-weight inflated sphere of aluminum-coated Mylar 100 feet in diameter. Echo is still visible in the sky as a fast-moving star observed by millions of people throughout the world. The polyester film, Mylar, whose chemical name is polyethylene terephthalate, was selected because of its outstanding strength, light weight, stability, and excellent adhesion to metals. The film is coated with a thin film of aluminum on each side to give an electrically conducting surface for the reflection of radio waves. Expected to survive only a few weeks, Echo is still capable of reflecting radio signals, though with considerable signal fluctuation.

An improved version of Echo is well along in development. The first sphere of somewhat heavier material with relatively thicker aluminum coatings was recently packed in its flight container and inflated to its full diameter of 140 feet on the ground. Ballistic flights will be made to confirm the reliability of inflation in space prior to launching as a satellite.

Many messages have been transmitted via Echo I since its launching. A short time ago, when Echo was in a favorable position, a message from your Executive Vice President, Mr. William T. Cruse, was sent, received, and recorded on tapes for reproduction on this occasion. I believe that this is a fitting way to open the Ninth National Plastics Exposition.

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